



vertical gradient in the Upper Glacial aquifer, except in the northern portion of the landfill, vertical leachate migration is dependent on density differences. The southeasterly hydraulic gradient transports the leachate horizontally as it sinks through the water column, and consequently the denser leachate reaches the bottom of the Upper Glacial aquifer well downgradient of the landfill.

Leachate impacts were evident, in varying degrees, in three of the Magothy monitoring wells. Samples collected from Well GM-1M were higher in TDS, chloride, ammonia, TKN, and specific conductance than the upgradient Magothy well, GM-2M, yet alkalinity was equal to background levels. In contrast, alkalinity, chloride, and specific conductance were elevated in Well GM-12M, while ammonia and TKN were at background levels. In Well GM-8M, chloride, ammonia, TKN, and specific conductance were slightly elevated in comparison with Well GM-2M, while alkalinity was again comparable with ambient levels.

Few ARARs exist for leachate indicator parameters (see Table 9). Of those available, TDS, chloride, and pH were exceeded (see Table 10). The distribution of TDS and chloride exceedences is consistent with the pattern described above and indicates an impact from the landfill. The pH standard, on the other hand, was exceeded at most well sites because of the naturally low pH of ambient water in the Upper Glacial and Magothy aquifers. In addition to the exceedences described above, five wells exceeded the ARAR for phenols, with all but two, GM-1D and GM-16D, located at the landfill.

Volatile Organic Compounds

Laboratory results for VOCs using the standard CLP analytical method are summarized in Table 4. Method 524.2 analytical results for the Magothy monitoring wells are summarized in Table 5. Contour maps of total VOC concentrations in the lower portion of the Upper Glacial aquifer were prepared from the data in Table 4, indicating two separate volatile organic plumes (see Figures 19 and 20). One plume passes through the

southwestern corner of the landfill, while the other is located approximately 2500 ft to the southeast. Comparison of the configuration of these plumes with the leachate plume illustrated on Figures 15 through 18 indicates that the Babylon landfill is not the source of the VOC contamination.

The VOCs detected consist primarily of tetrachloroethene, trichloroethene, and various breakdown products of these compounds, including 1,1-dichloroethene, 1,2-dichloroethene, and vinyl chloride. Contour maps of trichloroethene and tetrachloroethene concentrations in the lower portion of the Upper Glacial aquifer were prepared and indicate that three separate sources may exist. As shown on Figures 21 and 22, there are three distinct trichloroethene plumes, one passing through the southwestern corner of the landfill, one located approximately 2500 ft southeast of the landfill, and a third plume located in the vicinity of Feustal Avenue. In Figures 23 and 24, however, only two tetrachloroethene plumes are evident, which are similar in orientation to the two northernmost trichloroethene plumes described above. Although biodegradation of tetrachloroethene to trichloroethene may be partially responsible for the increased concentrations of trichloroethene detected in the vicinity of Feustal Avenue, the distribution of contaminants suggests that another source may be present in this area.

In addition to the compounds identified above, the following VOCs were detected in the Upper Glacial aquifer at concentrations above ARARs: methylene chloride, 1,1-dichloroethane, 1,1,1-trichloroethane, chlorobenzene, and the petroleum additives benzene, toluene, ethylbenzene, and xylene (BTEX). Of these compounds, 1,1,1-trichloroethene and its breakdown product, 1,1-dichloroethane, were detected at the highest concentrations, with a distribution similar to that described above for tetrachloroethene. The distribution of benzene and chlorobenzene in the Upper Glacial aquifer was comparatively random and does not appear to be related to a specific source. Toluene, ethylbenzene, and xylene were detected above ARARs in only one well (GM-25S). The appearance of BTEX in the water-table well GM-25S may be related to the construction activities underway at the Northern U landfill and general heavy equipment traffic at the landfill.

VOC contamination was not detected in any Magothy monitoring wells using the standard CLP analytical method. Using the more sensitive Method 524.2, the only compound detected was benzene, which appeared in Wells GM-1M and GM-5M at an estimated concentration of 0.1 ug/L, each, and in Well GM-15M at an estimated concentration of 0.3 ug/L. These levels were below the benzene ARAR of 0.7 ug/L.

Semivolatile Organic Compounds

Analytical results for semivolatile organic compounds (SVOCs) are summarized in Table 6. The only SVOCs detected were bis(2-ethylhexyl)phthalate, 1,2-dichlorobenzene, benzoic acid, and 2-Methylnaphthalene. With the exception of 1,2-dichlorobenzene, which was detected in all three Upper Glacial wells in Well Cluster GM-14, the semivolatile concentrations were randomly distributed. None of the Magothy wells exhibited semivolatile contamination and the only compound detected above ARARs in the Upper Glacial aquifer was 1,2-dichlorobenzene (18 ug/L in GM-14D and an estimated concentration of 5 ug/L in GM-14I). As mentioned previously, because of the relative absence of semivolatile contamination from ground-water samples collected during the January sampling round, samples collected in April were not analyzed for SVOCs.

Pesticides/PCBs

Analytical results for pesticides and polychlorinated biphenyls (PCBs) are summarized in Table 7. None of the samples contained PCBs and the only pesticides detected were beta- and gamma-BHC, dieldrin, heptachlor epoxide, and alpha- and gamma-chlordane. Since beta- and gamma-BHC, dieldrin, and heptachlor epoxide have ARARs of "not detected", all of the detections exceeded ARARs. For chlordane, only one concentration exceeded the ARAR of 0.1 ug/L, the estimated concentration of 0.11 ug/L of alpha-chlordane detected in Well GM-20S.

Most of the pesticide detections in the Upper Glacial aquifer were located in the southern portion of the study area, in the vicinity of Santapogue Creek, and are probably attributable to residential use. None of the Magothy wells exhibited pesticide contamination. As approved by the NYSDEC, because of the low level of pesticide/PCB contamination detected during the January sampling round, sampling for these parameters was discontinued during the April sampling round.

Metals

Analytical results for metals are summarized in Table 8. Arsenic, cadmium, chromium, iron, lead, manganese, sodium, and zinc were detected in the Upper Glacial aquifer at concentrations above ARARs (see Table 9). Iron, manganese, and sodium are common components of leachate, and the distribution of ARAR exceedences for these metals indicates an impact from the landfill. At every well site except GM-13, GM-21, and GM-22, which are outside the leachate plume, iron concentrations exceeded the ARAR of 300 ug/L. Similarly, manganese and sodium concentrations exceeded ARARs at every well site except GM-2, GM-13, GM-17, and GM-19, which are beyond the leachate plume. Although not detected at concentrations above ARARs, calcium, magnesium, and potassium concentrations were also elevated in Upper Glacial wells located within the leachate plume.

The source of the elevated arsenic, cadmium, chromium, lead, and zinc concentrations is less clear. A comparison of total and dissolved metals data suggests that higher concentrations of these metals in unfiltered samples may be attributable to local geology (i.e., the metals content of the native sediments). For example, total cadmium concentrations exceeded ARARs in 20 wells; however, in all but three of these, GM-7I, GM-24S, and GM-24D, dissolved cadmium concentrations were below the 5 ug/L standard. Similarly, total chromium concentrations exceeded ARARs in four wells, but only Wells GM-25S and GM-25D contained dissolved chromium at levels above the 50 ug/L standard. None of the wells that exhibited total arsenic, lead, and zinc concentrations above ARARs contained dissolved concentrations of these metals above their respective standards. Based

on these data, it appears that relatively low concentrations of these elements leach from the landfill. However, the chemical composition of the leachate may make metals within the native sediments more mobile.

The only metals detected at concentrations above ARARs in the Magothy aquifer were iron, manganese, and sodium. The Magothy wells that exhibited an impact from leachate also contained elevated concentrations of these metals. GM-8M and GM-12M contained iron, manganese, and sodium at concentrations above ARARs, while GM-1M contained iron and sodium at levels above their respective standards. Although Wells GM-5M and GM-15M did not exhibit an impact from the landfill based on leachate indicator analytical data, both contained iron at concentrations above the standard of 300 ug/L. In addition, Well GM-14M, the furthest downgradient Magothy well, contained iron, manganese, and sodium at concentrations above ARARs. Based on leachate indicator results, this well is beyond the influence of the leachate plume, suggesting that the Magothy aquifer may contain ambient concentrations of these metals in excess of ARARs.

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TABLES

From NYSDDEC RI: Task 2F, Surface-water and stream sediment
Sampling, Babylon Landfill R/F/S, Babylon, New York
October, 1991. Contact: George Heitzman (516) 457-1641

4

WATER-LEVEL MEASUREMENTS

The water-level in Santapogue Creek was measured at each of the surface-water sampling stations on January 7. Measurements were taken from a reference point on a permanent structure, such as a culvert or iron post. The elevations of these measuring points were surveyed in February 1991 by Baldwin & Cornelius, P.C and used with the ground- and surface-water-level data to construct the water-table map shown on Figure 2.

RESULTS

SURFACE-WATER SAMPLING

Analytical results for the surface-water samples are summarized in Tables 1 through 5. Relevant New York State Ambient Water Quality Standards/Guidance Values (AWQS/GVs) are listed in Table 6. Since the criteria for copper and lead are a function of hardness and the ammonia standard is dependent on sample temperature and pH, each sample has different AWQS/GVs for these parameters. Standards were not available for barium, calcium, magnesium, manganese, potassium, sodium, or any of the leachate indicator compounds, except ammonia.

Semivolatile organic compounds (SVOCs) were not present in any of the samples and the only volatile organic compounds (VOCs) detected were trichloroethene and chlorobenzene, both at levels below their respective AWQS/GVs (see Tables 1, 2, and 6). Although no polychlorinated biphenyls (PCBs) were detected, each of the samples contained one or more of the following pesticides in trace concentrations: gamma-BHC (lindane), aldrin, dieldrin, 4,4'-DDD, and alpha-chlordane (see Table 3). With the exception of aldrin, which was detected at concentrations of 0.055 and 0.060 micrograms per liter (ug/L) in the replicate samples from Station SW-5, all the pesticide concentrations were estimated. However, the concentrations were above New York State AWQS/GVs, which are below the method detection limits for these compounds. No pattern was discernible with respect to

sample location and it is likely that the appearance of trace levels of pesticides in these samples is attributable to residential use.

Metals data for the surface-water samples are presented in Table 4. Cobalt, iron, lead, and mercury were the only metals detected at concentrations above the New York State AWQS/GVs. In the case of cobalt, each of the detected concentrations was below the method detection limit. For iron, total concentrations ranged from 1,110 ug/L (SW-4) to 2,240 ug/L (SW-5), while dissolved concentrations ranged from non-detectable (SW-4) to 1,220 ug/L (SW-3), in comparison with the 300 ug/L standard. Lead was not detected in any of the filtered (dissolved) samples and was also not detected in two of the unfiltered (total) samples (SW-4 and SW-5). For the remaining samples, total lead concentrations ranged from 4.60B ug/L in Sample SW-2 to 10.9 ug/L in Sample SW-5 Replicate. Total mercury concentrations ranged from 0.28J ug/L (SW-5 Replicate) to 1.00J (SW-5), while dissolved concentrations ranged from 0.20B ug/L (SW-2) to 0.84 ug/L (SW-4), compared to the 0.2 ug/L AWQGV. Although no dominant upstream or downstream trends were evident for the metals data, barium, magnesium, manganese, potassium, and sodium were detected at slightly higher concentrations in Samples SW-4 and SW-5, while zinc and dissolved iron concentrations in these samples were slightly lower.

As indicated above, disparate results were obtained for the total lead and mercury concentrations in the replicate samples from Station SW-5. Since this variability was not evident for any of the other metals analyzed, it is likely that the differences resulted from the heterogeneity of the suspended solids in the two samples, rather than a sampling or analysis problem.

Analytical results for leachate indicator parameters are presented in Table 5. Hardness, total dissolved solids, alkalinity, chloride, ammonia, total Kjeldahl nitrogen, and specific conductance were higher at the upstream sampling locations, likely indicating an impact from the landfill. Sulfate concentrations, in contrast, were lower at the upstream locations. As described by Kimmel & Braids (1980), this decrease in sulfate content is

probably caused by the reducing environment associated with the landfill. This environment promotes the reduction of sulfate to sulfide and iron to its more soluble ferrous state, ultimately resulting in the precipitation of ferrous sulfide, which removes the free ions from solution. As a result, sulfate and dissolved iron concentrations tend to be lower closer to the landfill. The fact that this pattern was evident in surface water well south of the landfill suggests that leachate-bearing ground water is discharging into Santapogue Creek.

STREAM SEDIMENT SAMPLING

Analytical results for the stream sediment samples are summarized in Tables 7 through 12. Minimum and maximum regulatory criteria for detected organic compounds are provided in Tables 13 and 14. The minimum criteria were calculated using the lowest TOC concentration detected in the eight sediment samples (440 milligrams per kilogram [mg/kg]) and the lowest octanol/water partition coefficient (K_{ow}) listed for each compound in the "Groundwater Chemicals Desk Reference" (Montgomery and Welkom, 1990). The maximum criteria were calculated using the highest detected TOC concentration (2,900 mg/kg) and the highest listed values of K_{ow} . Specific criteria were not calculated for all eight sediment samples because, as mentioned previously, the values are provided as a reference only and, additionally, because TOC is expected to be highly variable in the sediments of Santapogue Creek.

As indicated in Table 7, the only samples containing VOCs were SS-1 and SS-8. In Sample SS-1, chloroform, trichloroethene, and tetrachloroethene were detected at estimated concentrations of 1, 3, and 4 ug/L, respectively. In Sample SS-8, 2-butanone, vinyl acetate, 4-methyl-2-pentanone, and 2-hexanone were each detected at a concentration of 13 ug/L, which is at or near the method detection limit. These "hits" appear to be spurious and unrelated to sample location.

Semivolatile analytical results are summarized in Table 8. SVOCs were detected in every sample except SS-7, which was collected from the Tooker Avenue wetlands area. In

Sample SS-1, the only SVOC detected was bis(2-ethylhexyl)phthalate, which was detected at an estimated concentration of 89 micrograms per kilogram [ug/kg]. The SVOCs detected in the remaining samples consisted mainly of polynuclear aromatic hydrocarbons (PAHs), which are characteristic of coal-tar distillates, such as those found in road tar and creosote. Presumably these compounds were transported into Santapogue Creek through storm-water runoff. Although there was no definitive upstream or downstream distribution pattern, PAH concentrations were highest at Station SS-8, possibly because of runoff from Tooker Avenue, which lacks storm sewer drainage in the vicinity of Santapogue Creek, and at Station SS-2, which is adjacent to the Long Island Railroad and likely received runoff from the railroad tracks.

In addition to PAHs, several substituted phthalate compounds were detected; however, with the exception of the bis(2-ethylhexyl)phthalate detected in Sample SS-5 (1,700 ug/kg), all the concentrations were estimated. Concentrations of phthalate compounds were highest at Station SS-5 and decreased both upstream and downstream of that sampling location. The source of this contamination is unknown.

As indicated in Table 9, nine pesticides were detected in the stream sediment samples, including gamma-BHC (lindane), aldrin, dieldrin, 4,4'-DDD, and alpha-chlordane, which were also detected in the surface-water samples. The most common compounds detected were alpha- and gamma-chlordane, which were found in seven of the eight samples. With the exception of the 29 ug/kg of 4,4'-DDT detected in Sample SS-4, the pesticide concentrations were all estimated. No pattern was discernable with respect to sample location, and it is likely that the pesticide content of the sediment samples is attributable to residential use.

Polychlorinated biphenyls (PCBs) were detected in only one sample, SS-3, which contained Aroclor-1254 at a concentration of 520 ug/kg. PCBs were not detected in any of the other stream sediment samples, or any of the surface-water samples, and the source of this contamination is unknown.

Analytical results for metals are summarized in Table 10. Antimony, selenium, silver, and thallium were not detected in any of the samples and arsenic, beryllium, cobalt, mercury, nickel, potassium, sodium, and vanadium were detected only at concentrations below their respective method detection limits. Of the remaining metals, cadmium, calcium, chromium, copper, iron, lead, and zinc were detected at the highest concentrations in Samples SS-4 and SS-5, while aluminum, barium, and manganese concentrations were highest in Sample SS-6, and magnesium was highest in Sample SS-1. The variability of these results may be due to the natural heterogeneity of sediments in Santapogue Creek.

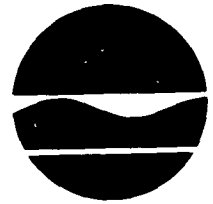
Analytical results for cyanide and TOC are presented in Tables 11 and 12. Cyanide was not detected in any of the samples, and TOC values ranged from 440 to 2900 milligrams per kilogram.

WATER-LEVEL MEASUREMENTS

The configuration of the water table on January 7 is shown on Figure 2. The hydraulic data confirm that Santapogue Creek is a gaining stream that receives ground-water discharge downgradient from the landfill.

TASK2F.DEL

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233 -7010



Thomas C. Jorling
Commissioner

JUN 25 1992

Mr. Walter Shoepf
ERRD-TPSS
Room 13-100
United States Environmental
Protection Agency, Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Shoepf:

RE: Babylon Landfill (DEC Site #152039)

As you requested, enclosed is the Department's groundwater and surface water data from the Babylon Landfill Remedial Investigation. Also enclosed is the Appendix containing the sampling logs and QA/QC data validation memorandums. **Please return these documents after you have reviewed and/or copied them.**

As we discussed, the Department believes that the high levels of organic contamination found in the area are not from the landfill, but from industrial sources adjacent to the site. One of these sources, Pride Solvents, is the subject of an EPA-lead RCRA corrective action investigation. The enclosed May 11, 1992 letter presents the conceptual site model that will be used in preparing the site Risk Assessment. This clearly states that the landfill plume is comprised of inorganic leachate parameters, and is bordered on either side by industrial organic contaminant plumes.

Please call me at 518-457-1641 if you have any questions about this site.

Sincerely,

George W. Heitzman, P.E.
Senior Environmental Engineer
Bureau of Central Remedial Action
Division of Hazardous Waste
Remediation

Enclosure

May 11, 1992

VIA FEDERAL EXPRESS

George Heitzman
Senior Sanitary Engineer
Bureau of Eastern Remedial Action
Division of Hazardous Waste Remediation
New York State Department of
Environmental Conservation (NYSDEC)
50 Wolf Road
Albany, New York 12233-7010

Subject: Babylon Landfill (Site #152039)
Risk Assessment

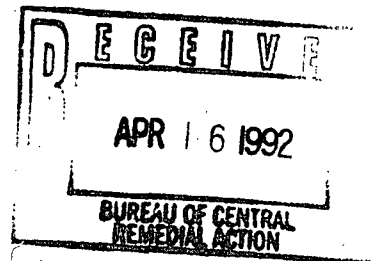
Dear Mr. Heitzman:

Geraghty & Miller, Inc. is currently preparing a baseline risk assessment for the Babylon Landfill. The purpose of the risk assessment is to determine whether the human health and environmental risks associated with the landfill are significant enough to warrant remedial action.

Based on the results of the Remedial Investigation (RI), four affected media have been identified: ground water, surface water, stream sediment, and air. The ground-water and air portions of the risk assessment have been completed, and human health risks associated with exposure to site-related contaminants in surface water and stream sediment have also been evaluated. However, the NYSDEC has requested that a Step II, Contaminant-Specific Impact Analysis be performed to determine whether site-related contaminants in surface water and stream sediment have impacted wildlife. Since the results of this study may have a bearing on overall site risk, Geraghty & Miller cannot finalize the risk assessment until the Impact Analysis has been completed. However, as we have discussed, ground water is the primary media of concern at the landfill, and since this pathway has already been addressed in the risk assessment, Geraghty & Miller can begin work on the Feasibility Study (FS). The purpose of this letter is to report our conclusions about the ground-water component of the risk assessment, so that we can proceed with the initial phases of the FS.

APPROACH

The risk assessment was conducted according to the guidelines specified in the United States Environmental Protection Agency (USEPA) guidance document entitled, "Streamlining the RI/FS for CERCLA Municipal Landfill Sites". This guidance document states that baseline risk assessments can be simplified for municipal landfill sites, since these sites have limited options available for remedial action (USEPA, 1990). The streamlining process involves the following:



FILEABLE Y-N	B.E.R.A.	FILE SECTION
FILE NAME		I
FILE CODE		II
FILE SECTIONS		III
FILE ELEMENT		IV
FILEABLE UNIT NO. DESC.		V
DRAFT OR FINAL		VI

1. The development of a conceptual model and identification of impacted media.
2. A comparison of site-related contaminant concentrations in impacted media to Applicable or Relevant and Appropriate Requirements (ARARs) to identify pathways that pose an unacceptable risk.
3. Once the affected pathways are identified (i.e. one or more contaminants exceed ARARs in a given medium), then the need for remedial action can be established.

The conceptual model developed for the Babylon landfill is presented below for NYSDEC review and comment. Although all site media are discussed in the model, only the ground-water data are reviewed in subsequent sections of this letter.

CONCEPTUAL SITE MODEL

Based on data collected during the Remedial Investigation, three contaminant release mechanisms have been identified: (1) leachate from the landfill entering ground water, (2) leachate-bearing ground water discharging into Santapogue Creek, and (3) vapor emissions from the landfill entering the atmosphere.

GROUND WATER

The first contaminant release mechanism, landfill leachate entering ground water, was determined from the ground-water sampling conducted by Geraghty & Miller during January and April 1991 (see Task 2E deliverable, Geraghty & Miller, Inc., 1992). A plume of leachate-bearing ground water was defined in the Upper Glacial aquifer, extending approximately 2.4 miles (12,500 ft) southeast of the landfill, with a maximum width of approximately 0.5 miles (2,500 ft). Leachate contamination was also evident in three of the six Magothy monitoring wells downgradient from the landfill: GM-1M, GM-12M, and GM-8M. In general, leachate-impacted ground water in both aquifers was characterized by higher alkalinity, hardness, and specific conductance than ambient ground water, and elevated concentrations of total dissolved solids (TDS), chloride, ammonia, and total Kjeldahl nitrogen (TKN) in comparison with background wells. Most of the leachate-impacted wells also exhibited elevated concentrations of the metals barium, calcium, iron, magnesium, manganese, potassium, and sodium.

In addition to the leachate plume, two plumes of volatile organic compound (VOC) contamination were detected in the Upper Glacial aquifer. One plume passes through the southwestern corner of the landfill property, while the other was detected approximately 2500 ft southeast of the landfill. The orientation of these plumes in relation to the leachate plume indicates that the landfill is not the source of VOC contamination (see Figures 1 and 2). Based on ground-water flow and the distribution of VOCs, the contamination likely originates in the industrial parks east and west of the landfill, with a potential third source located in the vicinity of Feustal Avenue.

None of the ground-water samples collected contained polychlorinated biphenyls (PCBs), and only trace concentrations of pesticides and semivolatile organic compounds (SVOCs) were detected. The distribution of pesticides and SVOCs was random, and does not suggest an impact from the landfill. As would be expected in as densely developed an area as Babylon, local residential, commercial, and industrial activity is probably responsible for this low-level contamination.

SURFACE WATER AND STREAM SEDIMENT

The second contaminant release mechanism, leachate-bearing ground-water discharging into Santapogue Creek, was determined from the surface-water sampling conducted by Geraghty & Miller in January 1991 (see Task 2F Deliverable, Geraghty & Miller, Inc., 1991). Leachate indicators, such as hardness, TDS, alkalinity, chloride, ammonia, TKN, and specific conductance were found to be higher in the northern portion of Santapogue Creek, particularly in the vicinity of the Tooker Avenue wetlands area. Metals commonly found in leachate, such as barium, magnesium, manganese, potassium, and sodium, were also detected at slightly higher concentrations in the northern portion of the creek, suggesting an impact from the landfill.

None of the surface-water samples contained SVOCs, and only trace concentrations of pesticides and VOCs were detected. As discussed above, the landfill is not a source of pesticide or VOC contamination in ground water; and since ground-water discharge is responsible for the landfill's impact on surface water, this contamination is probably attributable to other sources. Storm sewer discharge, surface-water runoff, and nearby residential, commercial, and industrial activity may be responsible.

Landfill impacts were not detected in stream sediment. Although some metals associated with landfill leachate, such as barium, calcium, iron, and manganese, were detected at higher concentrations in the northern portion of Santapogue Creek, the sampling results were highly variable and may just reflect the natural heterogeneity of the stream sediments. SVOCs were detected in all but one of the sediment samples; however, the compounds detected consisted predominantly of polynuclear aromatic hydrocarbons (PAHs), which are characteristic of coal-tar distillates, such as those found in road tar and creosote. Presumably, these compounds were transported into Santapogue Creek through storm-water runoff. Similarly, the trace concentrations of VOCs and pesticides detected in some samples are probably the result of normal urban activity.

AIR

The third contaminant release mechanism, air emissions from the landfill, was determined from the air sampling program conducted by RTP Environmental Associates in June 1991 (see Air Pathway Component Analysis, RTP Environmental Associates, Inc., 1991). Vapor concentrations of three VOCs (benzene, carbon tetrachloride, and tetrachloroethene) exceeded New York State standards in ambient air both up- and downwind of the landfill, with downwind

concentrations being slightly higher. The primary source of this contamination appears to be the soil gas vents that surround the landfill.

CONTAMINANT CHARACTERIZATION

Ground-water quality data from the field investigation were grouped according to sample location as follows: (1) upgradient Upper Glacial monitoring wells, (2) upgradient Magothy monitoring wells, (3) downgradient Upper Glacial monitoring wells impacted by leachate, and (4) downgradient Magothy monitoring wells. Monitoring wells within each group are listed in Table 1. Wells chosen to represent the occurrence of contaminants in the leachate plume were selected based on an alkalinity of 100 milligrams per liter (mg/L) or more and/or an ammonia concentration greater than 1 mg/L.

A statistical analysis was performed on each data group to determine potential contaminant exposure concentrations. In a conventional, quantitative risk assessment, exposure concentrations are used with estimates of contact rate, exposure frequency and duration, body weight, etc. to determine the reasonable maximum exposure (RME) of a typical receptor at a site. For this streamlined study, however, a semi-quantitative approach was used. Exposure concentrations were compared to ARARs to evaluate site risk.

According to USEPA guidance, the exposure concentration of a particular contaminant is equal to the 95 percent upper confidence limit (UCL) of the arithmetic mean (USEPA, 1989). Theoretically, this means that if a group of wells were sampled repeatedly, the average concentration of a contaminant detected in any given sampling round would be equal to or less than the UCL 95 percent of the time. Although the UCL does not reflect the maximum concentration that might be encountered at any one time, it provides a conservative estimate of the concentration that may be encountered over an extended period of time. This is a more realistic approach than assuming long-term contact at a contaminant's maximum detected concentration.

In some cases, however, the calculated UCL may exceed the maximum detected concentration. This generally happens when the UCL is calculated for a small data set or if the data set is highly variable (i.e., has a large standard deviation). In these instances, use of the maximum detected concentration as the theoretical exposure concentration is warranted.

UCLs for each data group were calculated as follows:

- Parameters that were never detected in a data group were not considered.
- Detected concentrations were used at the reported value, regardless of whether the data were qualified or not (i.e., followed by a B or J).
- Non-detects were represented by one-half the reported sample quantitation limit (SQL). If one-half the SQL exceeded a parameter's maximum detected

concentration in a particular data group, then the maximum value was substituted for one-half the SQL.

- When a parameter was also detected in a sample blank, the "5-or-10-times" rule was applied. That is, if the detected concentration was greater than 10 times the blank concentration for common laboratory contaminants (e.g., methylene chloride, acetone, toluene, or phthalates), or greater than 5 times the blank concentration for other parameters, then the result was treated as a detect at the reported value. If, however, the detected concentration was less than 5 or 10 times the blank concentration, then the result was treated as a non-detect according to the rules specified above.
- When duplicate samples, replicate samples, or re-check samples were analyzed, the highest result for each parameter was used.

The results of the statistical analysis are provided in Tables 2 through 5. The information presented in these tables includes, for each substance detected, the frequency of detection (ratio of the number of detects to the total number of samples analyzed), the range of SQLs for non-detects, the range of detected concentrations, the arithmetic mean concentration, the UCL on the mean, and the exposure concentration, which is the lesser of the UCL and the maximum detected concentration. ARARs are also presented for comparison with the exposure concentrations.

CONSTITUENTS OF CONCERN

In the Upper Glacial aquifer, the following parameters had exposure concentrations above ARARs: benzene, 1,2-dichloroethene, tetrachloroethene, trichloroethene, vinyl chloride, iron, manganese, sodium, phenol, gamma-BHC, and dieldrin (see Table 4). In the Magothy aquifer, the only parameters with exposure concentrations exceeding ARARs were iron, manganese, and sodium (see Table 5).

As discussed in the conceptual model, the pesticides and VOCs listed above are not site-related and therefore do not represent a site-related health risk. Phenol may or may not be site-related; however, the frequency of detection (4 out of 64 samples) was extremely low. Although the levels of phenol detected (0.01 to 0.02 mg/l) are above the ARAR of 0.001 mg/l, they are well below any health-based standard that would be derived from the reference dose of 0.6 mg/kg/day (IRIS, 1992). The constituents of concern (COCs) for the Babylon landfill are therefore limited to iron, manganese, and sodium. Toxicity summaries for these metals are presented in Table 6. Iron and sodium are considered essential human nutrients or normal components of human diets, and at the levels detected in ground water, do not pose a health risk.

EXPOSURE ASSESSMENT

Currently, there are no active drinking-water wells in the Upper Glacial aquifer in the vicinity of the site, so any risks associated with exposure to ground-water are limited to the Magothy aquifer. The Suffolk County Water Authority (SCWA) has five pumping stations located downgradient from the landfill that draw water from the Magothy aquifer. The well fields are located at Gordon Avenue, 12th Street, Tenety Avenue, Sawyer Avenue, and Albin Avenue. Of these, only the 12th Street and Albin Avenue pumping stations are directly in line with the leachate plume.

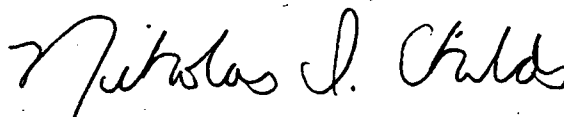
All the SCWA wells are screened at depths of 260 feet or more below land surface. The shallowest well is 12th Street #3, located approximately 4,000 feet south of the landfill. Iron and sodium were detected in this well at concentrations above ARARs, while free ammonia exceeded 1 mg/L (Dalo, 1992). Well #2 at 12th Street, which is screened at about the same depth as Well #3, exhibited similar levels of iron and sodium; however, free ammonia was not detected. These results suggest that 12th Street Wells #2 and #3 may have been impacted by the landfill. None of the other SCWA wells in the study area exhibited an impact from leachate.

Geraghty & Miller will proceed with the FS based on the need to address the three COCs in ground water (iron, sodium, and manganese), with the understanding that refinement may be needed if additional concerns are raised by the Contaminant-Specific Impact Analysis.

We look forward to your comments. In the meantime, if you have any questions, please call.

Sincerely,

GERAGHTY & MILLER, INC.



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RISK.LTR